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OF ASTRODAPSIS

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REVISION OF SOME CALIFORNIA SPECIES OF ASTRODAPSIS

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Extensive field work throughout the central Coast Ranges of California during the past two years has shown that various species of the genus *Astrodapsis* are of value in establishing the stratigraphic correlation of Upper Miocene and Lower Pliocene formations.

During the paleontological study of these late Tertiary marine sediments, the valuable works of Clark and Twitchell,¹ and Kew,² were found to be almost indispensable in the determination and identification of the various genera and species of the Pacific Coast Echinoidea. However, a study of the original description and figure of the type of *Astrodapsis antiselli* Conrad suggested that the workers had misidentified this species, which is the type of the genus *Astrodapsis*.

Through correspondence with the Curator, Division of Mollusks, U. S. National Museum, photographs of specimens were obtained which confirmed this opinion, and indicated that the specimen figured by Clark and Twitchell (U. S. National Mus. Cat. No. 165466a) cannot be regarded by Kew as a type specimen of *A. antiselli* Conrad. Furthermore, this specimen is not from the original lot, nor even from the type locality. A photograph of the above mentioned specimen shows it is not a true *Astrodapsis antiselli* as originally defined and figured by Conrad. Unfortunately, Kew followed Clark and Twitchell and recognized this figured specimen as the holotype. The problem is therefore two-fold: (1) biologic identification of species, and (2) nomenclatorial. In order to correct this confusion it is necessary to make several corrections and, in addition, propose one new name, to wit:

Astrodapsis salinasensis, new name

"*Astrodapsis antiselli* Conrad," of Clark and Twitchell, 1915, also of Kew, 1920, but not of Conrad, 1856.

¹ Clark, W. B. and Twitchell, M. W. The Mesozoic and Cenozoic Echinodermata of the United States. U. S. Geological Survey, Monogr. 54, 1915.

² Kew, W. S. W. Cretaceous and Cenozoic Echinoidea of the Pacific Coast of North America. Univ. Cal. Pub. Geol., Vol. 12, no. 2, pp. 23-236, 1920.

Determinative characters.—Clark and Twitchell, verbatim:³ “Test medium in size; regularly oval in marginal outline, longer than broad, slightly truncated at anterior end, slightly pointed at posterior end, with faint notches opposite ends of petals; margin rounded and very thick, almost as thick as rest of test. The whole form is considerably depressed, almost equally so from edge to edge, and therefore subdiscoidal; the upper surface with broad flattened ambulacral ridges alternating with narrow interambulacral depressions; apex eccentric anteriorly, in front of depressed apical system; lower surface slightly concave. Ambulacral petals large, broad, tumid, especially near apical system; poriferous zones narrow, at first diverging, then converging slightly from one-fourth to one-third the way to margin and again diverging to the wide open ends which are nearly to the margin. Peristome central; the main ambulacral grooves straight, well defined, and rather deep from peristome to margin and continuing as faint lines over margin to near apex, two faint lines are given off about half way to margin, which continue over margin to near apical system. Periproct small, infra marginal, almost marginal.”

Dimensions.—Specimen B, type, (U. S. National Mus. Cat. No. 165466a): length, 57 mm.; width, 50 mm.; height, 14 mm.

Localities.—Specimen B (No. 165466a): “2 miles south of San Lucas, Monterey County, Cal.” (Clark and Twitchell).

Collection.—U. S. National Mus. Cat. No. 165466, Specimen A, cotype. U. S. National Mus. Cat. No. 165466a, Specimen B. Both the type and the specimens collected by Ralph Arnold, which include specimens A and B.⁴

Remarks.—*Astrodapsis salinasensis* (No. 165466a) misidentified as “*Astrodapsis antiselli* Conrad” by Clark and Twitchell, and by Kew, is herein figured (Plate 7, figs. 2a, 2b, and 2c) for comparison with the original type of true *Astrodapsis antiselli* Conrad (U. S. National Mus. Cat. No. 13337), which is labelled “Conrad’s type,” from Estrella, Monterey County, California. (See Plate 7, figs. 1a, and 1b). *A. salinasensis* differs from *A. antiselli* Conrad in the following characters:

<i>Astrodapsis salinasensis</i>	<i>Astrodapsis antiselli</i> Conrad
<i>Test</i> : Discoidal, oval; slightly notched.	Pentagonal; markedly notched opposite ends of petals.
<i>Margin</i> : Broadly rounded and thick; almost as thick as rest of test,—“biscuit shaped.”	Slightly rounded; greatest elevation adjacent to the depressed apical system.
<i>Apical system</i> : Moderately depressed.	Deeply depressed.
<i>Tubercles</i> : Very prominent.	Not prominent.
<i>Petals</i> : Low, broad, and tumid.	Elevated, narrow, angular.
<i>Interambulacral areas</i> : Rounded, shallow grooves.	Angular, deep grooves. *

³ *Op. cit.* p. 198.

⁴ This information from Clark and Twitchell, 1915, p. 199.

Distribution.—Geographically *Astrodapsis salinasensis* occurs abundantly in the fine, medium to coarse, white, littoral marine sandstones at the top of the Santa Margarita formation, or sandstone facies of the Upper Miocene Monterey Shale, throughout the entire Salinas Valley, Monterey County, California, as well as in similar sandstones of the Santa Margarita formation as exposed along Bean Creek, Santa Cruz County, California, and the uppermost Santa Margarita sandstones exposed along Saucelito Creek, Nipomo Quadrangle, San Luis Obispo County, California.

Stratigraphically *Astrodapsis salinasensis* occurs in a monoclinical, upper Miocene section, approximately 250 feet above organic and siliceous shales containing a *Nonion schencki* foraminiferal assemblage, which in turn overlies sandstones containing *Astrodapsis tumidus*, *Astrodapsis whitneyi*, *Ostrea titan corrugata*, and associated faunal assemblage. It occurs below sandstones containing *Astrodapsis* cf. *jacalitosensis* and lower Pliocene mollusks belonging to the Jacalitos faunal assemblage.

Associated faunal assemblage.—*Astrodapsis salinasensis* occurs with the following forms: *Pecten estrellanus* Conrad (18-20 rib var.), *Tritonalia* sp., *Balanus concavus* Bronn, "*Tamiosoma*" *gregaria* Conrad, *Astrodapsis spatiosus* Kew.

Additional revision.—In the monographs by Clark and Twitchell, and Kew, the true *Astrodapsis antiselli* Conrad was named *Astrodapsis arnoldi* through the unfortunate misidentification mentioned above. In order to correct this nomenclatorial problem, it is necessary to consider those forms originally described by Kew (1921) as subspecies of *Astrodapsis antiselli* Conrad, or to regard them as of full specific rank. The revised nomenclature of all the forms involved in this problem is as follows:

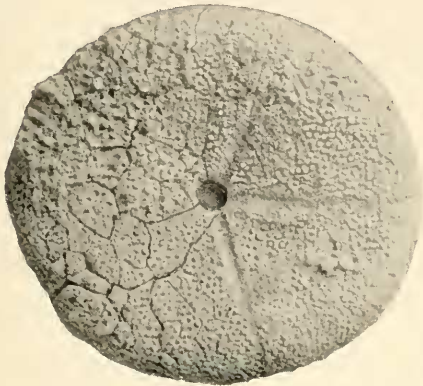
Old arrangement (Kew)	New arrangement
<i>Astrodapsis arnoldi</i> arnoldi	<i>Astrodapsis antiselli</i> Conrad
" " <i>depressus</i>	" <i>depressus</i>
" " <i>fresnoensis</i>	" <i>fresnoensis</i>
" " <i>crassus</i>	" <i>crassus</i>
" " <i>spatiosus</i>	" <i>spatiosus</i>
" " <i>peltoides</i>	" <i>peltoides</i>
" <i>Astrodapsis antiselli</i> Conrad" of Kew, not Conrad	<i>Astrodapsis salinasensis</i> , new name

Acknowledgments.—The writer is indebted to Dr. Alexander Wetmore, Assistant Secretary of the Smithsonian Institution, and Mr. Wm. B. Marshall of the Division of Mollusks, U. S. National Museum, for permission to reproduce photographs of the type of *Astrodapsis antiselli* Conrad (U. S. National Mus. Cat. No. 13337); photographs of *Astrodapsis salinasensis* new name (U. S. National Mus. Cat. No. 165466a) were supplied through the courtesy of the U. S. Geological Survey. He is also grateful to Dr. Hubert G. Schenck of Stanford University, and Dr. U. S. Grant of University of California at Los Angeles, for suggestions concerning nomenclatorial problems and the preparation of the manuscript.

PLATE 7

All figures approximately natural size.

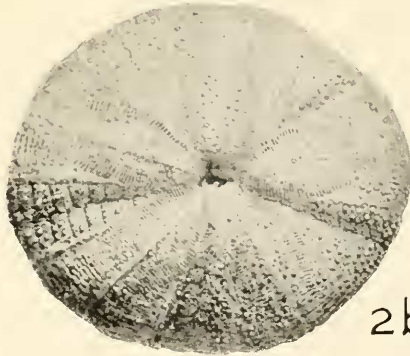
- Fig. 1a. *Astrodapsis antiselli* Conrad.
Genotype, U. S. National Mus. Cat. No. 13337. Upper surface of test. Estrella, Monterey Co., California.
- Fig. 1b. *Astrodapsis antiselli* Conrad.
Same specimen. Lateral view of test.
- Fig. 2a. *Astrodapsis salinasensis*, new name.
Holotype, U. S. National Mus. Cat. No. 165466a, Specimen B.
Lower side of test. Two miles South of San Lucas, Monterey Co., California.
- Fig. 2b. *Astrodapsis salinasensis*, new name.
Same specimen. Upper surface of test.
- Fig. 2c. *Astrodapsis salinasensis*, new name.
Same specimen. Lateral view of test.



2 a.



1 a.



2 b.



2 c.



1 b.

